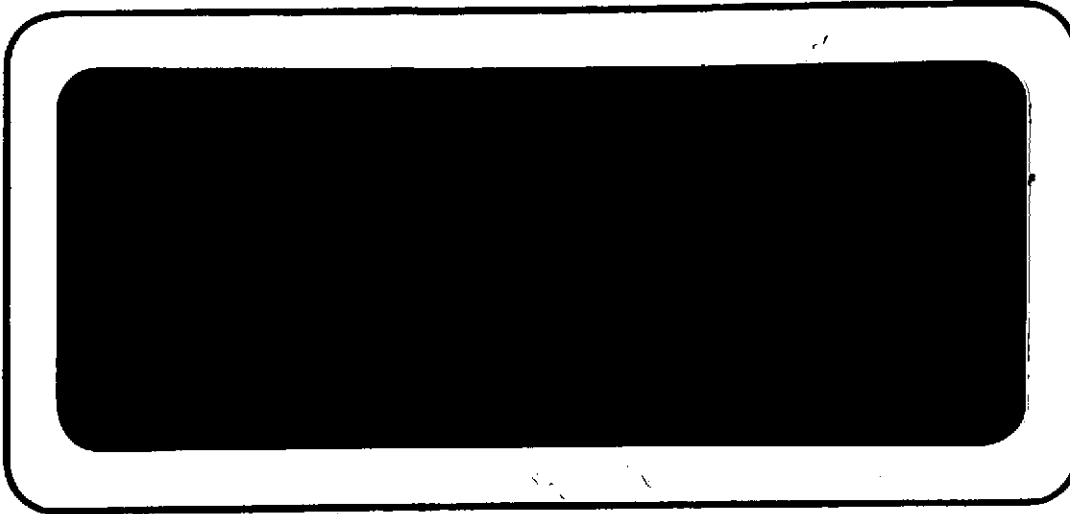


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(E73-11019) EVALUATION OF DIGITAL
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EVALUATION OF DIGITAL CORRECTION
TECHNIQUES FOR ERTS IMAGES

September, 1973

Interim Report for Period March, 1973 - August, 1973

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16. Abstract This document reports on the progress attained during the six months extending from March, 1973 through August, 1973 under Contract No. NAS5-21814. The purpose of this contract is to demonstrate precision correction of bulk digital ERTS imagery by digital methods, and to evaluate the techniques utilized from the point of view of precision and speed. Included herein are examples of imagery processed during this report period and a description of the program for the next report interval (September-October, 1973).			
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PREFACE

This document reports on the progress attained during the six months extending from March, 1973 through August, 1973, under Contract No. NAS5-21814. The purpose of this contract is to demonstrate precision geometric and radiometric correction of bulk digital ERTS imagery by digital methods, and to evaluate the techniques utilized from the point of view of precision and speed. Included herein are first examples of MSS imagery processed during the final phase (Phase III) of this contract which began at the end of July, 1973.

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1.0 INTRODUCTION

Phase II of this contract, during which various processing algorithms were exercised utilizing the first ERTS data received, was concluded in April, 1973 with the submission of a Data Analysis Plan for Phase III (continuing data analysis). Formal written authorization to proceed with Phase III was received from NASA in July, 1973. Activity during the six months period covered by this Interim Report therefore includes participation in the ERTS-1 Symposium, the preparation of the Data Analysis Plan, and the processing of the first imagery under Phase III.

2.0 REVIEW OF ACTIVITY: March-August, 1973

2.1 Background

The previous Interim Report for September, 1972-February, 1973 described the first six months of contract activities and outlined the techniques utilized in this contract for correcting ERTS imagery. First results obtained using these techniques were included in the aforesaid report and published in the proceedings of the Symposium on Significant Results Obtained from ERTS-1 in March, 1973.

2.2 March-August, 1973

During March 5-9, 1973 initial results obtained from this contract were presented to the Symposium on Significant Results Obtained from ERTS-1. These results were included in the previous Interim Report for September, 1972-February, 1973. Following the symposium, a Data Analysis Plan for Phase III (continuing data analysis) of the contract was prepared and submitted on April 20, 1973. Contract activities for Phase III of the contract began with the receipt of written approval of the plan on July 23, 1973.

3.0 ACTIVITY: July-August, 1973

3.1 Processed Images

The first scene processed during Phase III of the contract was 1062-15190, containing the cities of Baltimore and Washington, D.C. Figure 1 shows a detail centered around the city of Baltimore and its harbor taken from the first MSS band of the scene, derived from bulk computer tape (CCT) data. This region was selected instead of Washington because of the richness of detail and because silt in the Potomac (resulting from recent storm activity) reduced land/water contrast significantly. Gould electrostatic line printer output was photoreduced to create the image, utilizing a 3x3 dot matrix to represent each pixel with ten gray levels (0-9). It was judged best in this case to use the negative, rather than the positive, so as to bring out more clearly the land/water contrast.*

Figure 2 shows a region $\sim 60\text{Km} \times 45\text{Km}$ after processing CCT data by the techniques described in the previous Interim Report using TRW's Cubic Convolution Process, and reproduced as described in the preceding paragraph. The maximum relative geometric error measured in this image without GCP refinement, compared to Coast and Geologic Survey maps, was found to be $\sim 200\text{m}$.

Figure 3 shows the bulk image in the upper left, and the processed image using nearest neighbor interpolation (upper right), bilinear interpolation (lower right), and TRW's Cubic Convolution Process (lower left). Note the many one pixel image discontinuities characteristic of nearest neighbor interpolation, particularly evident for the road intersection in the upper left corner of the processed image. Bi-

* That is, "gray" land stands out better against "white" water than against "black" in the line printer output.

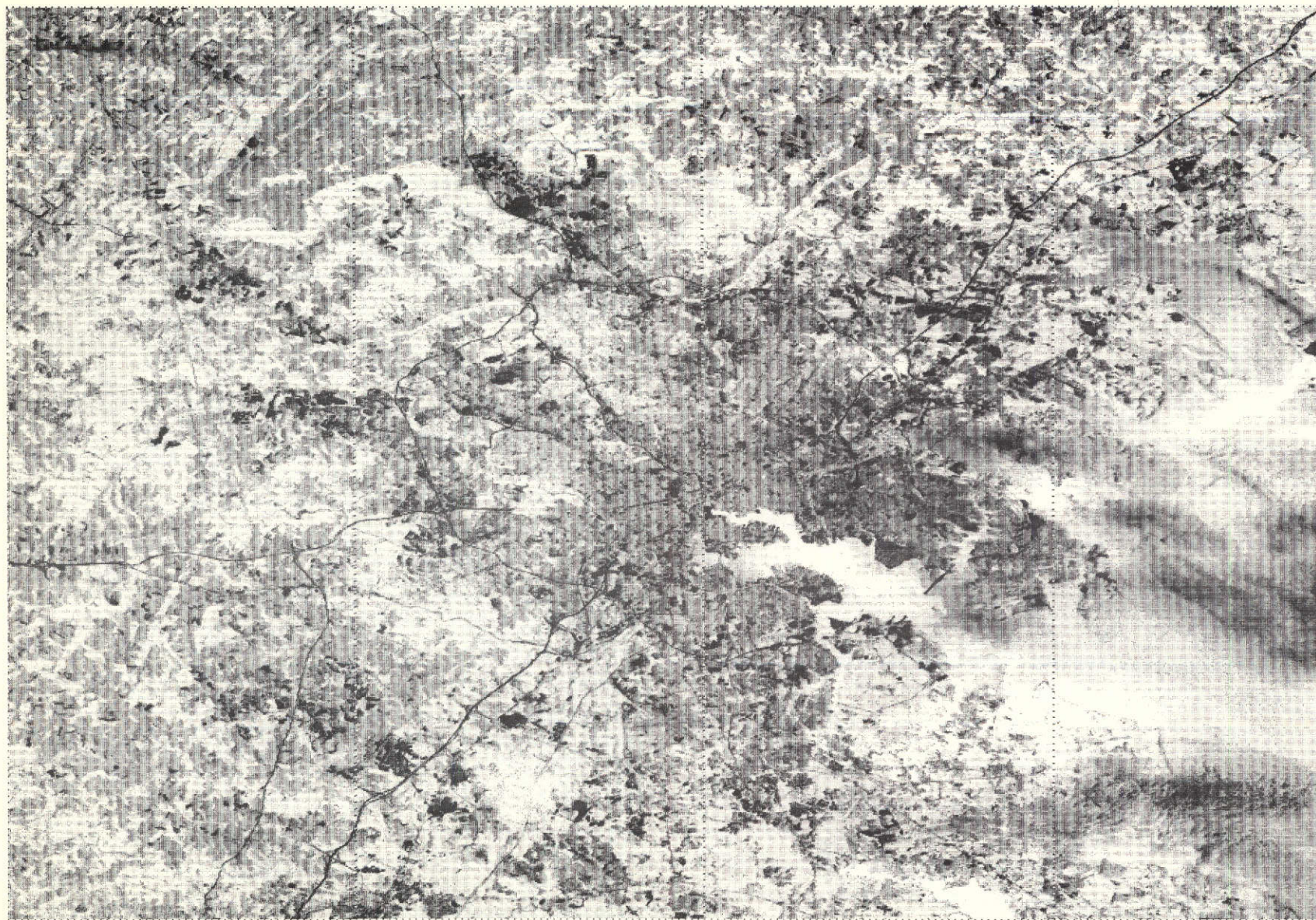


Figure 1. Detail From Bulk Image 1062-15190-4. Bulk CCT data was reproduced as a negative on a line printer. The city of Baltimore and its harbor are in the center of the image.



Figure 2. Detail of Image 1062-15190-4.

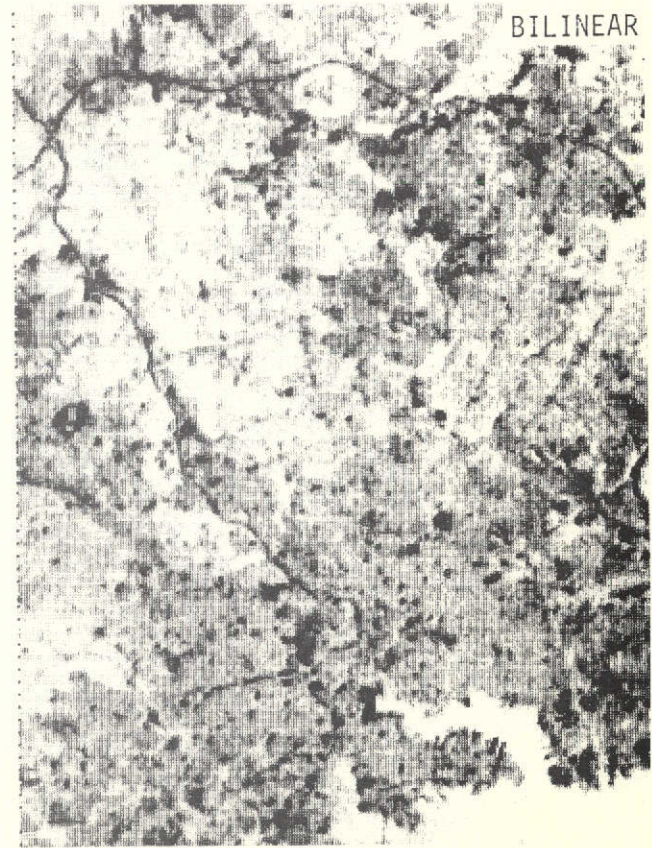
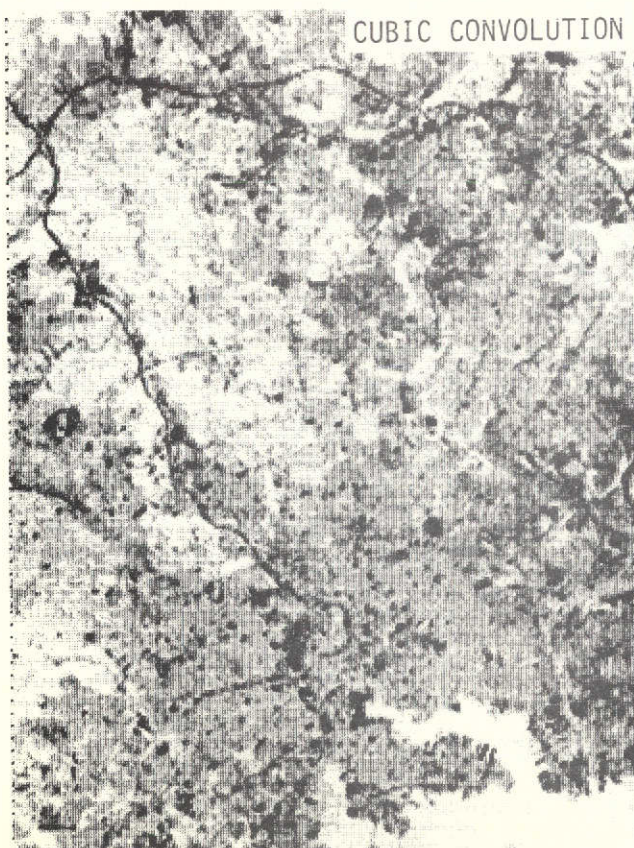
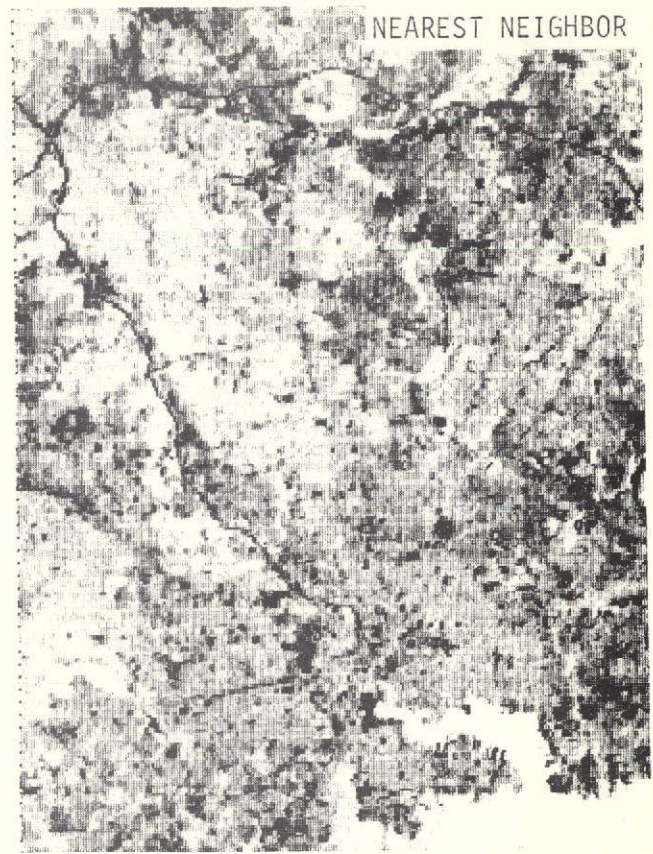


Figure 3. Corrected Image Detail for Three Interpolation Algorithms.

linear interpolation, on the other hand, eliminates these discontinuities, at the expense of image resolution. Finally, the image processed by the Cubic Convolution Process shows none of the nearest neighbor image discontinuities, and no loss of resolution.

3.2 Published Articles

A paper containing the aforesaid results has been submitted to the Symposium on Management and Utilization of Remote Sensing Data (to be held in Sioux Falls, South Dakota), for inclusion in the proceedings. The Symposium is scheduled for 29 October-1 November 1973.

3.3 Problems

None.

4.0 PROGRAM FOR SEPTEMBER-OCTOBER, 1973

During the next reporting interval, it is planned to extend the results described herein to cases in which GCP attitude refinement is employed.